# THE PROBLEM OF TERMINOLOGY IN THE RUSTS

IMPERIAL BUREAU OF MYCOLOGY
INSTITUTE

J. C. Arthur and F. D. Kern

[Reprinted from Mycologia, Vol. XVIII, No. 2, March-April, 1926.]

[Reprinted from MYCOLOGIA, Vol. XVIII., No. 2, March–April, 1926.]

# THE PROBLEM OF TERMINOLOGY IN THE RUSTS[1]

J. C. ARTHUR AND F. D. KERN

There is today more or less confusion regarding the use of terms for the various vegetative and fruiting structures in the plant rusts. Twenty years ago the senior author pointed out (Bot. Gaz. **39**: 219–222. 1905) that the terminology then in use was "clumsy, ambiguous, poorly correlated, and quite inadequate to show homologies properly." This remark referred to the old terms *aecidium*, *uredo*, *teleuto*, etc., and their derivatives. At that time the terms *aecium*, *uredinium*, *telium*, etc., were proposed. These newer terms have been more or less widely used, but there has not been the uniformity in their application which is desirable. While the newer terms resemble the older ones they are not identical with them and are not designed merely to replace them. It is believed that the newer terms have a significance never possessed by the older terms and which the older terms cannot now be made to assume. But a matter of far more fundamental importance than the selection of the terms themselves is the outlining of concepts which are to be the basis for applying terms. For the sake of brevity it seems possible to develop a number of conceptions in the form of dicta. They are as follows:

1. The conception of rusts should give consideration both to the vegetative body (mycelium) and to the fruiting structures (sori) which arise from it.

2. The vegetative body is either long-cycle (macrocyclic), consisting of two unlike and discontinuous generations, or short-cycle (microcyclic), consisting of one continuous generation.

3. The fruiting structures, the sori, containing spores that are either inefficient, having no capacity to bring about infection, or efficient, containing spores having the capacity to bring about infection.

4. The inefficient sori (pycnia) are present or absent in both

[1] Read before the Mycological Section of the Botanical Society of America at the Kansas City meeting, December 30, 1925.

Joint contribution from the Botanical Department of Purdue University Agricultural Experiment Station and the Botanical Department of the Pennsylvania State College.

macrocyclic and microcyclic rusts, in the former only with the first generation.

5. The sori with efficient spores in a macrocyclic rust are the essential initial forms (aecia) and the essential final forms (telia), with which may or may not be associated intermediate repeating forms (uredinia); the efficient sori in a microcyclic rust resemble either the macrocyclic aecia or they resemble the macrocyclic telia, and may be designated by the same terms.

While some of these principles have been generally recognized they have not been formulated heretofore in this manner.

The point brought out in the first dictum does not need detailed elaboration. It is intended merely to draw attention to the fact that we often fall into the habit of talking about rusts as if they were collections of sori, instead of minute plants bearing fruiting structures.

For some time it has been recognized that rusts may be divided into two classes: (1) long-cycle and (2) short-cycle. We are indebted to Dr. G. Lagerheim, of Stockholm, for the suggestion of the terms *macrocyclic* and *microcyclic* which seem to us to be very appropriate and satisfactory. Heretofore, the separation into these two classes usually has been on the basis of the spore-forms produced. The second dictum points out that the logical separation is on the basis of the vegetative body. It is believed that as here stated it should be acceptable to most mycologists. A macrocyclic rust is said to have two unlike and discontinuous generations. The question whether these represent gametophyte and sporophyte need not be settled in order to permit a satisfactory arrangement of our terminology. The same is true regarding the nature of the single continuous generation in the microcyclic rusts.

In the third dictum it is pointed out that some of the sori bear spores incapable of infection while others bear spores capable of infection. It is proposed to use the term *pycnium* for the sori with inefficient spores. Neither the term nor the manner of defining it raises the question whether or not these are vestigial sex organs. On that point each worker may entertain his own views. The important point in this connection is that these inefficient fruiting structures are in all structural essentials *sori*, whatever may be their origin or function.

The fact that the pycnia may be present or absent in both macrocyclic and microcyclic rusts is so well known that further comment is unnecessary. The significance of their presence or absence is another question not necessarily to be discussed in this connection.

The fifth dictum states that there are two efficient spore-forms essential to a macrocyclic rust, the initial form and the final form. A third efficient but unessential form is the intermediate repeating stage, which is not always present. For the sori of the initial spore-stage, which vary in form in different rusts, it is proposed to use *aecium* as a general term. The structures included here are often called by various special names according to form, being derived from form-genus names. When there is a cupulate peridium with catenulate spores, *aecidium* is used; if the peridium is blister-like, the structure is a *peridermium;* if there is no peridium and the spores are catenulate, *caeoma* is the term; if there is no peridium and the spores are stylosporic, it has been customary to call the structure a *primary uredo.* The use of " primary uredo " in this connection is unfortunate since there are cases where the first sori produced of the genuine repeating stage are different in appearance from the later sori and the term *primary uredo,* if useful at all, would be applicable here. It seems most logical and serviceable to have a common term for the sori of these several initial stages which have been passing under the various terms, aecidium, peridermium, caeoma, roestelia, and "primary uredo." These and other old terms may still be useful although often confusing or inadequate. They are largely founded on gross structural characters which in themselves are insufficient to delimit any sorus. For example, an ordinary description of a caeoma structure might apply in one rust to the initial spore-stage while in another it might apply to the repeating stage. To say *caeomoid aecium* would carry with it a definiteness of nature which is desirable in analyzing these complicated species. The intermediate repeating stage has been called the uredo-stage and there is less confusion regarding the situation here than in the initial stage. The chief objection to *uredo* is that the same word is doing duty as a form genus and that it does not lend itself to the making of a uniform set of derivatives as does the term *uredinium.* For the sorus of the final spore-

stage which ends the life cycle in all macrocyclic rusts, although only produced at long intervals in some species, the term *telium* seems most acceptable. It refers to a single sorus which in the older terminology is called a teleutosorus or teleutospore-sorus. Speaking collectively, *telial* stage replaces the awkward term teleutospore-stage.

As pointed out in the Botanical Gazette paper twenty years ago it is necessary to say in the older terminology that aecidia appeared, after a time they were followed by the uredo, and finally the teleutospore stage was developed. For the three stages representing analogous spore-structures three different types of terms are required. In the newer terminology it is possible to say that aecia appeared, and that they were followed in turn by uredinia and telia. These terms can be used in the singular or plural, in the adjective form, or in combination with spore. It can be justly claimed that they do away with ambiguity and permit a conciseness and uniformity of statement not possible with the older terms.

Turning now to the microcyclic rusts it is pointed out in the fifth dictum that they have but one type of sori with efficient spores, which in some rusts resemble the macrocyclic aecia, and in others the macrocyclic telia, and that they may be called respectively aecia and telia. This is interpreted that the sori and spores in a species of *Endophyllum* may be called aecia and aeciospores, and in a species such as *Puccinia Malvacearum* they may be called telia and teliospores.

During the summer of 1925 the authors had the good fortune of discussing some of the problems here presented with numerous mycologists at home and abroad. This statement is made not to intimate that these conclusions represent in any sense a consensus of opinion but to acknowledge that this presentation has been influenced by the ideas and suggestions gained from the conferences with our colleagues. We realize, as has been pointed out to us, that scientific terms like ordinary language expressions are not dictated from ideals but gain standing by usage. It has seemed to us worth while, nevertheless, to make a contribution which may have its effect on usage.